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The overall goal of this grant is to examine the effects of physical and psychological stress as risk factors for preterm delivery among an ethnically diverse population of 1,000 active duty military women recruited from the prenatal clinic at Wilford Hall Medical Center. A stress challenge test will be administered to study participants at 24-26 weeks of gestation. Additional data to examine the relationship of preterm delivery with stress and responsivity to stress will be obtained from questionnaires and military and medical records.			
Thus far 391 participants, 94% of those eligible, have been enrolled; 183 have delivered, 15 of them prematurely.			
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FOREWORD

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Maureen Hatch 9/14/98
PI - Signature Date

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INTRODUCTION

Subject, Purpose, Scope

In a population of pregnant active-duty military women, we are evaluating the hypothesis that physical or psychological stress may lead to shortened gestation, in part through maternal circulatory response. To account for the influence of female reproductive hormones, cardiovascular responsivity is being measured for all subjects at the same point in gestation. Effects of aerobic fitness level will be explored by incorporating data from the active-duty women's most recent fitness assessments. Greater susceptibility to infection, another possible consequence of stress¹, might also play a role in promoting preterm delivery. Stress-induced alterations in immune function may result in increased susceptibility to urogenital tract infections. There is increasing evidence that such infections raise the risk of preterm delivery². Insofar as available data permit, we are also considering the role of infection as well as stress in determining risk of preterm delivery.

Preterm birth is a major cause of perinatal morbidity and mortality. While the frequency of births of low weight ($\leq 2,500$ g) infants has declined somewhat since 1970, this decline appears to have occurred primarily among full-term as opposed to preterm low birth weight infants. Furthermore, there is no evidence that the rate of births before 37 weeks of gestation has declined³. Nationally about 8-10% of all deliveries are preterm, but the rate varies considerably (e.g., from a low of 4% to as high as 15%).

Established risk factors for preterm delivery include black race, single marital status, low socioeconomic status, previous low birth weight or preterm delivery, multiple second trimester spontaneous abortions, cigarette smoking, multiple gestations, and obstetrical and medical complications such as placental abnormalities, gestational bleeding, and cervical and uterine anomalies³. Kramer has estimated, however, that only 25-30% of preterm births can be explained by known risk factors other than chronic medical conditions or pregnancy complications.

Two potentially important risk factors that have elicited considerable interest and controversy are occupational physical activity and psychosocial stress. These factors may be

particularly relevant for women who have a pronounced hemodynamic response to stress.

Previous Work:

Occupational physical activity and pregnancy outcome

Concern about possible adverse reproductive effects of employment reflects the increasing participation of pregnant women in the labor force. Although there is a substantial literature on the effect of employment-related physical activity on pregnancy outcome, no general consensus has been reached on such effects. A growing number of studies, however, suggest that prolonged standing and long working hours may pose a risk to pregnancy.

Employment per se does not appear to increase the risk of premature delivery. For example, several studies have reported that women who are employed outside the home have either no increased risk or a reduced risk of preterm delivery when compared to women who are not employed⁴⁻⁸, possibly reflecting the more favorable demographic and behavioral profile of working women. An analysis of the 1980 National Natality Survey⁹ found that pregnant women workers were more likely to be of optimal reproductive age (20-34 years old), to be more highly educated, have a higher family income, initiate prenatal care earlier, gain more weight during pregnancy, and smoke slightly less heavily. However, employed women had fewer previous births and more unfavorable reproductive histories (more stillbirths, spontaneous abortions, and induced abortions).

Military. The association between employment-related activity and pregnancy outcome has been assessed specifically for women in the military. The risk of preterm birth among U.S. Army active-duty primigravidae has been examined by Ramirez et al³³. As the authors noted, this is a unique population because of its large size and homogeneity, and because the U.S. Army military occupational specialties undergo physical demand assessments. The authors found an increased risk of preterm delivery for women employed in the highest physical activity levels. Although this relation was unchanged after adjustment for the effects of age, race, marital status, socioeconomic status, or education, the authors suggested that the results be interpreted with

caution because there were missing data when maternal and infants' hospital records could not be matched. The increased risk of preterm birth among active-duty military women was, however, confirmed by Fox et al.¹⁰ who compared approximately 200 active-duty women to a general clinic population and a population matched for parity and race. Fox et al. also found that in addition to an elevated risk of preterm delivery, active-duty women had a two-fold increase in frequency of toxemia. There is also some indirect evidence. The rates of preterm delivery reported in a recent study of U.S. enlisted women -- 10.5% among whites, 13.5% among blacks -- are high relative to the rate that would be expected in a "low risk" population of healthy young women¹¹.

Stress and response to stress

Whether stress during pregnancy affects the fetus adversely is a longstanding concern. The stress process has been described as one in which "environmental demands tax or exceed the adaptive capacity of an organism, resulting in psychological and biological changes that may place persons at risk for disease"¹². Stressors could affect outcome of pregnancy by acting directly on physiological processes - through the release of stress hormones or by altering circulatory responses or immune parameters - without the perception of stress and without the arousal of negative emotions¹³. Alternatively, the effects of stressors may be mediated through cognitive appraisal, followed by distress if available coping resources are perceived as inadequate¹⁴. Additional pathways by which either stressors or distress may influence pregnancy outcome are through health behaviors, including smoking, drinking alcohol, nutritional intake or the use of medical services.

Direct effects of stress on either preterm delivery or growth retardation have been thought to be mediated by the release of glucocorticoids and catecholamines (epinephrine and norepinephrine). These hormones have physical effects that may include increases in maternal heart rate and blood pressure and decreased blood flow to systems, including the uteroplacental unit, that are nonessential to the physical task. This raises the possibility that maternal cardiovascular reactivity could be an indicator of enhanced risk. Women of lower socioeconomic

status and African-American women have higher rates of preterm delivery. Among the explanations proposed to account for this are a greater susceptibility to stressors, possibly due to more marked physiological stress responses. For example, heightened stress responses resulting from the inability to attain valued goals have been implicated in the development of hypertension among African American men¹⁵. It has been proposed that a similar mechanism might account in part for the less favorable pregnancy course and outcomes of African American women¹⁶.

Cardiovascular reactivity. Studies of blood pressure and heart rate responses to standardized laboratory stressors (e.g., mental arithmetic tasks) show that reactivity or heightened response may be a risk factor for cardiovascular disease^{17,18}. Men exhibit greater reactivity than women¹⁹, consistent with their higher risk of heart disease and suggesting a modulating role for female hormones. Such a role is supported by results from a study of pregnant women who showed a diminished blood pressure response during challenge compared to their prepregnancy levels as well as to nonpregnant controls.²⁰ Aerobic fitness has also been associated with lower heart rate reactivity²¹ and reduced neuroendocrine responses.

BODY

Subject recruitment

Participants are prenatal patients attending Wilford Hall Medical Center, Lackland Air Force Base and Brooke Army Medical Center, Fort Sam Houston. Pregnant active duty women are being interviewed at entry into prenatal care and seen again between 24-26 weeks of gestation for administration of a stress challenge test to evaluate cardiovascular responsivity.

No exclusionary criteria other than multiple gestations are being imposed. If subjects have a history of hypertension, for example or a prior preterm delivery, this will be dealt with at the stage of statistical analysis. Furthermore, we are not recruiting an external control group but will make comparisons internally between women at higher and lower levels of each exposure/susceptibility measure.

The population of active-duty military women in the San Antonio, Texas area generally

enters prenatal care early, between 6-12 weeks of gestation. The group is multi-ethnic: African-American, Hispanic, Asian and White. For purposes of this study, race/ethnicity is defined based on what a woman considers herself to be.

Data Collection

Data are being collected using military personnel records, medical records, psychophysiological testing and administration of structured questionnaires.

Military records. Active duty women undergo aerobic fitness testing with cycle ergometry yearly, during their birth month. A fitness assessment is recorded based on their performance, using a score of 1-6. During pregnancy women are exempt from fitness testing, and the length of time since the most recent fitness assessment will therefore vary depending on a subject's birth month. Nonetheless, the assessment from this controlled aerobic testing will be valuable as a baseline fitness measure.

The armed forces also has a system of job-related service codes. This has been used in previous studies to assign level of physical activity. We will supplement the service codes with additional data obtained through the questionnaires.

Psychophysiology Testing. At 24-26 weeks of gestation, heart rate, blood pressure and respiration will be measured during performance on computer-controlled mental arithmetic and Stroop-color word matching tasks while in the seated position. Subjects will be given general instructions about the procedures. They will rest for a 5-minute base period while blood pressure, respiration and heart rate are obtained on a minute by minute basis using a Finapres BP Monitor (Ohmeda, Atlanta, GA) and a Hewlett-Packard EKG monitor. The experimental tasks will be presented and scored on a PC compatible computer using software developed by our consultant Dr. Richard Sloan, from the Department of Behavioral Medicine at Columbia University. The order of the two tasks will be counter-balanced to insure that any differences found between the two tasks are not due to order effects. Each task will be five minutes in length. Tasks will be

separated by a five minute rest period. Post-test heart rate, blood pressure and respiration will be determined upon completion of the tasks.

Psychophysiology testing and electronic transfer of data to Columbia University are working well. All participants have complied with this task.

Medical Records. A data abstraction form has been developed and reviewed by our clinical collaborator, Dr. William Barth, Chairman of the Obstetrics/Gynecology Department, Wilford Hall Medical Center. The form will be used to obtain data from the prenatal record and the labor and delivery record on: vaginal infections, pregnancy complications such as pregnancy-induced hypertension, labor length and delivery (spontaneous, induced), as well as birthweight and gestational age at delivery.

Gestational age in days will be determined whenever possible from early ultrasound examination. In a recent study of military women, about 75% of the deliveries were dated by ultrasound¹. In cases where sonography is not available, gestational age will be calculated as date of delivery minus date of the last menstrual period.

Preterm delivery: Note will be made of whether labor was induced or spontaneous. Induced deliveries will be classified as medical interventions. Spontaneous preterm deliveries will be classified as resulting from premature labor or the result of preterm premature rupture of membranes (PPROM).

Questionnaire. A structured questionnaire is being administered by trained interviewers at entry into the study, between 12-14 weeks of gestation. Certain information collected at baseline will be updated when the subject undergoes psychophysiological testing at about week 25. The following risk factors are of primary interest:

Job-related physical activity is being assessed by asking about hours worked per day and per week, hours spent sitting, hours spent standing in a sedentary posture, hours spent in light or moderate labor, or heavy or strenuous labor.

Leisure-time physical activity is being assessed based on a questionnaire developed by

Dr. Leslie Bernstein²² that inquires about team and individual athletic activities.

Psychosocial job stress is being assessed using two approaches: (1) relevant subscales from the NIOSH job stress questionnaire, and (2) relevant scales of skill discretion necessary to apply the Karasek job strain model.

Psychological health and life stress outside of work are being assessed using the 14-item Perceived Stress Scale (PSS) developed by Sheldon Cohen²³, the 12-item General Health Questionnaire (GHQ) developed by David Goldberg²⁴, and the Beck Inventory Scale.

Social support system. The NIOSH instrument includes a scale measuring support from supervisors, coworkers, friends and family. In addition, we have included items asking about intimate social support, specifically whether the subject has a work confidant and/or partner confidant.

Infections. Data on infections during pregnancy will be collected during the follow-up interview as well as through abstraction of laboratory medical records.

Other risk factors. Questions will be included about sociodemographic and anthropometric characteristics, obstetrical, gynecological and medical history, and lifestyle factors.

Second trimester update. Subjects will be asked to update information on the major hypothesized risk factors (physical activity, occupational stress) as well as on confounding factors such as pregnancy complications and cigarette smoking. The PSS, GHQ and Beck questionnaires will be administered a second time as well.

Quality control of data collection

Immediately after completion of an interview, the interviewer (i.e., the Nurse Coordinator or her assistant) reviews the questionnaire and recontacts the participant in the event of missing data or inconsistencies. Drs. Hatch and Berkowitz will monitor interviews during visits to the study site to insure adherence to protocol, and will provide re-training as necessary. Finally, data will be entered throughout the period of data collection, and any problems identified as a result

of built-in computer logic or consistency checks will be resolved by calling back study participants.

Dr. Sloan has been reviewing computer output from the physiological testing on an ongoing basis.

The quality of record abstraction is being monitored by Drs. Hatch and Berkowitz by re-abstracting a random sample of 5% of the records in batches sent to New York every few months.

Data Management

Data are entered by the research assistant in San Antonio. Dr. Lapinski has created a data-entry program using Microsoft Access that includes range and internal consistency checks. The dataset will be converted into a SAS dataset and all data analysis will be performed using SAS statistical software. Thus far, data have been entered for 242 of the 391 participants currently enrolled.

RESULTS

As of 15 October 1998, a total of 564 potentially eligible women have been contacted and asked to participate in the study. Of these, 23 (4%) refused to participate, 134 (24%) were excluded due to their inability to remain in the San Antonio area through the entire pregnancy, because of a transfer or separation from the military, and 16 (3%) were excluded due to multiple gestations, leaving a total of 391 participants. This represents 69% of those approached and 94% of those eligible. Thirty subjects were subsequently lost to follow-up due to spontaneous pregnancy termination.

To date, 327 (90%) have completed the baseline questionnaire, 249 (69%) have completed the follow-up questionnaire, and 198 (55%) have participated in the cardiovascular responsivity testing. Delivery data have been completed on 183 (51%) subjects. Of these, 15 (8%) have delivered preterm, 4 at less than 37 wks, 4 at less than 36 wks, 5 at less than 35 wks, 1 at 31 wks, and 1 at 23 wks.

Descriptive statistics on age, race, marital status, and branch of the military are available for the 242 participants whose questionnaire data have been entered. Summary tables are presented below.

Age	
Age	Percent
<20	8.7
20-24	39.7
25-29	31.8
30+	19.8

Race/Ethnic Group	
Race	Percent
White	59.1
Black	21.9
Asian	2.5
Hispanic	12.0
Native American	0.8
Other	3.7

Marital Status	
Marital	Percent
Married	24.9
Common law	2.5
Single	17.8
Separate/Divorce	5.8

Branch of Military	
Military Branch	Percent
Army	24.9
Air Force	72.2
Navy	2.9

Data on the mean values and ranges for responses to the various items in the NIOSH Job Stress instrument are presented in Appendix I.

DISCUSSION

The mechanics of the study are working well. Enrollment is proceeding at or slightly above the predicted rate. This is true in spite of the fact that almost a quarter of prospective subjects have proved to be ineligible because of impending transfers or separation from the service. Among those enrolled, compliance with the protocol is excellent.

The participants are relatively young (only 20% are age 30+), and are ethnically diverse. Twenty-four percent of the pregnant subjects are single (17.8%), separated or divorced (5.8%). As a result of recent administrative changes, 25% of participants are drawn from the Army, and 3% from the Navy.

Ranges observed for the stress measures indicate good variability. Subjects appear to be using the full range of responses. Variability is important since our study design depends on internal comparisons. Judging from the mean values, workload and responsibility as well as job control appear to be significant sources of stress for this group of subjects.

Given the small numbers of events to date, it would be premature to overinterpret the preterm delivery rate. Although the current rate is 8%, in August the rate was 12%. Such fluctuations are to be expected with numbers based on less than 200 deliveries.

PROBLEMS

Fortunately, we have not yet encountered any serious problems.

CONCLUSION

Subject recruitment and data collection are proceeding as planned and in accordance with the Statement of Work. Thus, 391 women have been enrolled in the study to date, and the completeness of information obtained through interviewer-administered questionnaire is excellent.

Since the guidelines of the American College of Obstetricians and Gynecologists on work in pregnancy are out of date, and the U.S. government has no national regulations on hours of work, job tasks or duration of work during pregnancy, employers themselves must formulate such policies -- ideally on the basis of scientifically sound, mechanistically based studies. To help resolve the existing uncertainties, we are focusing on individual stress responses in evaluating exposure to physical and psychological work stress as risk factors for preterm delivery. The resulting information might not only help in determining work policies but also in improving understanding of the etiology of preterm birth.

REFERENCES

1. Cohen S, Williamson GM. Stress and infectious disease in humans. *Psychological Bulletin* 1991;109:5-24.
2. Romero R, Mazor M. Infection and preterm labor. *Clinical Obstetrics and Gynecology* 1988;31:553-584.
3. Berkowitz GS, Papiernik E. Epidemiology of preterm birth. *Epidemiologic Reviews* 1993;15:414-43.
4. Berkowitz GS, Kelsey JL, Holford TR, et al. Physical activity and the risk of spontaneous preterm delivery. *J Reprod Med* 1983;28:581-8.
5. Hartikainen-Sorri A-L, Sorri M. Occupational and socio-medical factors in preterm birth. *Obstet Gynecol* 1989;119:309-22.
6. Launer LJ, Villar J, Kestler E, et al. The effect of maternal work on fetal growth and duration of pregnancy: a prospective study. *Br J Obstet Gynaecol* 1990;97:62-70.
7. Mamelle N, Laumon B, Lazar P. Prematurity and occupational activity during pregnancy. *Am J Epidemiol* 1984;119:309-22.
8. Saurel-Cubizolles MJ, Kaminski M. Work in pregnancy: its evolving relationship with perinatal outcome (a review). *Soc Sci Med* 1986;22:431-42.
9. Savitz DA, Wheland EA, Rowland AS, et al. Maternal employment and reproductive risk factors. *Am J Epidemiol* 1990;132:933-45.
10. Fox ME, Harris RE, Brekken AL. The active-duty military pregnancy: A new high-risk category. *Am J Obstet Gynecol* 1977;129:705-7.
11. Adams MM, Read JA, Rawling JS, et al. Preterm delivery among black and white enlisted women in the United State Army. *Obstet Gynecol* 1993;81:65-71.
12. Cohen S, Kessler RC, Gordon LU. Strategies for measuring stress in studies of psychiatric and physical disorders. In: *Measuring Stress*. Editors: Cohen S, Kessler RC, Gordon LU. New York: Oxford University Press, 1995, pp. 3-26.
13. Baum A, Grunberg NE, Singer JE. The use of psychological and neuroendocrinological

- measurement in the study of stress. *Health Psychology* 1982;1:217-36.
14. Lazarus RS, Folkman S. Stress, Appraisal, and Coping. New York NY: Springer, 1984.
 15. Dressler WW. Lifestyle, stress, and blood pressure in a Southern black community. *Psychosomatic Medicine* 1990;52:182-198.
 16. David RJ, Collins JW. Bad outcomes in black babies: race or racism? *Ethnicity and Disease* 1991;1:236-244.
 17. Fredrikson M, Matthews KA. Cardiovascular responses to behavioral stress and hypertension: A meta-analytic review. *Annals of Behavioral Medicine* 1990;12:30-9.
 18. Markovic N, Matthews KA, Huston SL, et al. Blood pressure reactivity to stress varies by hypertensive status and sex in Nigerians. *Am J Epidemiol* 1995;142:1020-8.
 19. Matthews KA, Davis MC, Stoney CM, et al. Does the gender relevance of the stressor influence sex differences in psychophysiological responses? *Health Psychology* 1991;10:112-20.
 20. Matthews KA, Rodin J. Pregnancy alters blood pressure responses to psychological and physical challenge. *Psychophysiology* 1992;26(2):232-40.
 21. McCubbin JA, Cheung R, Montgomery TB, et al. Aerobic fitness and opioidergic inhibition of cardiovascular stress reactivity. *Psychophysiology* 1992;29(6):687-97.
 22. Bernstein L, Henderson B, Hanisch R, et al. Physical exercise and reduced risk of breast cancer in young women. *J Natl Cancer Inst* 1994;86:1403-8.
 23. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Social Behav* 1983;24:385-96.
 24. Goldberg DP, Hillier VF. A scaled version of the General Health Questionnaire. *Psychol Med* 1979;9:139-45.

Appendix I

Means and Ranges for Stress Measures at Baseline: First 242 Subjects

Variable	Label	N	Mean	Minimum	Maximum
OSH02B	How long working this shift (mo)	239	33.0	1.00	216
OSH03	3. How often do you change shifts	240	1.78	1.00	7.00
OSH04	4. How many hrs/wk do you normally work	241	44.1	10.0	80.0
OSH05A	5a. Climbing or balancing	242	1.57	1.00	5.00
OSH05B	5b. Lifting, carrying, pulling, pushing	242	2.52	1.00	5.00
OSH05C	5c. Moving around a lot	242	3.59	1.00	5.00
OSH05D	5d. Exerting a lot of physical effort	242	2.25	1.00	5.00
OSH05E	5e. Hours of uninterrupted standing	242	2.33	0.00	45.0
OSH06	6. Level of noise high	242	1.70	1.00	2.00
OSH07	7. Level of lighting poor	241	1.86	1.00	2.00
OSH08	8. Summer temperature comfortable	231	1.38	1.00	2.00
OSH09	9. Winter temperature comfortable	231	1.36	1.00	2.00
OSH10	10. Humidity uncomfortable	242	1.70	1.00	2.00
OSH11	11. Air circulation good	241	1.25	1.00	2.00
OSH12	12. Air clean	242	1.22	1.00	2.00
OSH13	13. Protected from dangerous substances	241	1.17	1.00	2.00
OSH14	14. Overall quality of environment poor	240	1.90	1.00	2.00
OSH15	15. Work area(s) awfully crowded	242	1.67	1.00	2.00
OSH16	16. Verbal abuse or confrontation	242	1.93	1.00	5.00
OSH17	17. Threat of physical harm or injury	242	1.39	1.00	5.00
OSH18	18. Physically assaulted	242	1.02	1.00	2.00
OSH19	19. Certain about authority	242	5.12	1.00	2.00
OSH20	20. Clear, planned goals and objectives	242	5.06	1.00	7.00
OSH21	21. Things should be done differently	242	3.80	1.00	7.00
OSH22	22. Divided time properly	242	5.50	1.00	7.00
OSH23	23. Assignment without needed help	242	3.55	1.00	7.00
OSH24	24. Knowing what responsibilities are	242	6.18	1.00	7.00
OSH25	25. Bend or break a rule or policy	242	2.19	1.00	7.00
OSH26	26. Groups who operate differently	242	4.14	1.00	7.00
OSH27	27. Know exactly what is expected	242	5.74	1.00	7.00
OSH28	28. Receive conflicting requests	242	3.65	1.00	7.00
OSH29	29. Accepted by one but not others	242	3.65	1.00	7.00
OSH30	30. Inadequate resources	242	3.92	1.00	7.00
OSH31	31. Explanation is clear	242	2.85	1.00	7.00
OSH32	32. Work on unnecessary things	242	5.33	1.00	7.00
OSH33	33. Variety of tasks	242	2.95	1.00	7.00
OSH34	34. Availability of supplies	242	3.00	1.00	5.00
OSH35	35. Order of tasks	242	3.00	1.00	5.00
OSH36	36. Amount of work	242	3.60	1.00	5.00
OSH37	37. Pace of work	242	2.87	1.00	5.00
OSH38	38. Quality of work	242	3.43	1.00	5.00
OSH39	39. Arrangement/decoration of work area	242	4.40	1.00	5.00
OSH40	40. Deciding who does what	242	3.18	1.00	5.00
OSH41	41. Schedule of work	241	2.15	1.00	5.00
OSH42	42. When things will be done	242	2.22	1.00	5.00
OSH43	43. Policies, procedures and performance	242	2.16	1.00	5.00
OSH44	44. Training other workers	242	2.28	1.00	5.00
OSH45	45. Arrangement of furniture/equipment	242	2.48	1.00	5.00
OSH46	46. Work ahead and take a break	242	3.19	1.00	5.00
OSH47	47. General influence	241	2.91	1.00	5.00
OSH48	48. Work very fast	242	3.03	1.00	5.00
OSH49	49. Work very hard	242	3.21	1.00	5.00
OSH50	50. Little time	242	2.81	1.00	5.00
OSH51	51. Great deal to be done	242	3.55	1.00	5.00
OSH52	52. Marked increase in workload	242	3.13	1.00	5.00
OSH53	53. Marked increase in concentration	242	3.12	1.00	5.00

Variable	Label	N	Mean	Minimum	Maximum
OSH54	54. Marked increase in speed of thinking	242	3.04	1.00	5.00
OSH55	55. Use skills/knowledge from school	242	3.56	1.00	5.00
OSH56	56. Do the things done best	242	3.42	1.00	5.00
OSH57	57. Use skills from experience/training	242	3.23	1.00	5.00
OSH58	58. How much slowdown in the work load	242	2.56	1.00	5.00
OSH59	59. How much time to think	242	3.02	1.00	5.00
OSH60	60. How much work load	242	3.67	1.00	5.00
OSH61	61. Quantity of work others expect	242	3.81	1.00	5.00
OSH62	62. Time to do all work	242	3.44	1.00	5.00
OSH63	63. How many projects/assignments/tasks	241	3.38	1.00	5.00
OSH64	64. How many lulls	242	2.68	1.00	5.00
OSH65	65. Responsibility for future of others	242	2.71	1.00	5.00
OSH66	66. Responsibility for job security	242	2.14	1.00	5.00
OSH67	67. Responsibility for morale	241	3.05	1.00	5.00
OSH68	68. Responsibility for welfare and lives	242	2.87	1.00	5.00
OSH69	69. Great deal of concentration	242	1.72	1.00	4.00
OSH70	70. Remember many different things	242	1.36	1.00	4.00
OSH71	71. Keep mind on work at all times	242	2.02	1.00	4.00
OSH72	72. Take it easy and still get work done	242	2.33	1.00	4.00
OSH73	73. Let mind wander and get work done	242	2.83	1.00	4.00
OSH74	74. Take same type of job again	242	1.79	1.00	3.00
OSH75	75. Take same/different/no job	242	1.88	1.00	3.00
OSH76	76. Recommend similar job to friend	242	1.62	1.00	3.00
OSH77	77. All in all how satisfied with job	242	1.98	1.00	4.00
OSH78	78. Make a plan to solve the problem(s)	242	3.67	1.00	5.00
OSH79	79. Go on as if nothing has happened	242	1.99	1.00	5.00
OSH80	80. Feel responsible for the problem(s)	242	2.53	1.00	5.00
OSH81	81. Wish you could change the problem(s)	242	2.27	1.00	5.00
OSH82	82. Talk to boss/coworkers about problem	242	3.58	1.00	5.00
OSH83	83. Become involved in outside activity	241	2.52	1.00	5.00
OSH84A	84a. your immediate supervisor (boss)	242	3.67	1.00	5.00
OSH84B	84b. other people at work	242	3.46	1.00	5.00
OSH84C	84c. your spouse/partner	242	4.04	1.00	5.00
OSH84D	84d. your relatives	240	3.30	1.00	5.00
OSH84E	84e. your friends	242	3.50	1.00	5.00
OSH85A	85a. your immediate supervisor (boss)	242	3.90	1.00	5.00
OSH85B	85b. other people at work	242	3.87	1.00	5.00
OSH85C	85c. your spouse/partner	242	4.50	1.00	5.00
OSH85D	85d. your relatives	241	4.38	1.00	5.00
OSH85E	85e. your friends	241	4.36	1.00	5.00
OSH86A	86a. your immediate supervisor (boss)	241	3.93	1.00	5.00
OSH86B	86b. other people at work	242	3.57	1.00	5.00
OSH86C	86c. your spouse/partner	242	4.33	1.00	5.00
OSH86D	86d. your relatives	241	3.84	1.00	5.00
OSH86E	86e. your friends	240	3.92	1.00	5.00
OSH87A	87a. your immediate supervisor (boss)	242	3.80	1.00	5.00
OSH87B	87b. other people at work	242	3.48	1.00	5.00
OSH87C	87c. your spouse/partner	242	4.50	1.00	5.00
OSH87D	87d. your relatives	241	4.42	1.00	5.00
OSH87E	87e. your friends	241	4.30	1.00	5.00

Variable	Label	N	Mean	Minimum	Maximum
OSH02B	How long working this shift (mo)	159	39.7	1.00	180
OSH03	3. How often do you change shifts	159	1.82	1.00	7.00
OSH04	4. How many hrs/wk do you normally work	160	43.3	10.0	76.0
OSH05A	5a. Climbing or balancing	160	1.48	1.00	5.00
OSH05B	5b. Lifting, carrying, pulling, pushing	160	2.47	1.00	5.00
OSH05C	5c. Moving around a lot	160	3.47	1.00	5.00
OSH05D	5d. Exerting a lot of physical effort	160	2.23	1.00	5.00
OSH05E	5e. Hours of uninterrupted standing	160	1.80	0.00	40.0
OSH06	6. Level of noise high	160	1.75	1.00	2.00
OSH07	7. Level of lighting poor	160	1.84	1.00	2.00
OSH08	8. Summer temperature comfortable	152	1.26	1.00	2.00
OSH09	9. Winter temperature comfortable	154	1.24	1.00	2.00
OSH10	10. Humidity uncomfortable	160	1.71	1.00	2.00
OSH11	11. Air circulation good	160	1.19	1.00	2.00
OSH12	12. Air clean	158	1.20	1.00	2.00
OSH13	13. Protected from dangerous substances	160	1.13	1.00	2.00
OSH14	14. Overall quality of environment poor	160	1.89	1.00	2.00
OSH15	15. Work area(s) awfully crowded	160	1.68	1.00	2.00
OSH16	16. Verbal abuse or confrontation	160	1.89	1.00	5.00
OSH17	17. Threat of physical harm or injury	160	1.44	1.00	5.00
OSH18	18. Physically assaulted	160	1.03	1.00	2.00
OSH19	19. Certain about authority	160	5.40	1.00	7.00
OSH20	20. Clear, planned goals and objectives	160	5.49	1.00	7.00
OSH21	21. Things should be done differently	160	4.03	1.00	7.00
OSH22	22. Divided time properly	160	5.71	1.00	7.00
OSH23	23. Assignment without needed help	160	3.51	1.00	7.00
OSH24	24. Knowing what responsibilities are	160	6.21	1.00	7.00
OSH25	25. Bend or break a rule or policy	160	2.34	1.00	7.00
OSH26	26. Groups who operate differently	160	4.58	1.00	7.00
OSH27	27. Know exactly what is expected	160	5.88	1.00	7.00
OSH28	28. Receive conflicting requests	160	3.86	1.00	7.00
OSH29	29. Accepted by one but not others	160	4.11	1.00	7.00
OSH30	30. Inadequate resources	160	2.88	1.00	7.00
OSH31	31. Explanation is clear	160	5.46	1.00	7.00
OSH32	32. Work on unnecessary things	156	3.11	1.00	7.00
OSH33	33. Variety of tasks	160	2.94	1.00	5.00
OSH34	34. Availability of supplies	160	2.91	1.00	5.00
OSH35	35. Order of tasks	160	3.69	1.00	5.00
OSH36	36. Amount of work	160	2.94	1.00	5.00
OSH37	37. Pace of work	160	3.40	1.00	5.00
OSH38	38. Quality of work	160	4.39	1.00	5.00
OSH39	39. Arrangement/decoration of work area	159	3.21	1.00	5.00
OSH40	40. Deciding who does what	160	2.21	1.00	5.00
OSH41	41. Schedule of work	160	2.21	1.00	5.00
OSH42	42. When things will be done	160	2.31	1.00	5.00
OSH43	43. Policies, procedures and performance	160	2.41	1.00	5.00
OSH44	44. Training other workers	160	2.60	1.00	5.00
OSH45	45. Arrangement of furniture/equipment	160	2.36	1.00	5.00
OSH46	46. Work ahead and take a break	160	3.19	1.00	5.00
OSH47	47. General influence	160	2.92	1.00	5.00
OSH48	48. Work very fast	160	3.06	1.00	5.00
OSH49	49. Work very hard	160	3.18	1.00	5.00
OSH50	50. Little time	160	2.74	1.00	5.00
OSH51	51. Great deal to be done	160	3.52	1.00	5.00
OSH52	52. Marked increase in workload	160	3.09	1.00	5.00
OSH53	53. Marked increase in concentration	160	3.03	1.00	5.00

Variable	Label	N	Mean	Minimum	Maximum
OSH54	54. Marked increase in speed of thinking	160	3.02	1.00	5.00
OSH55	55. Use skills/knowledge from school	160	3.59	1.00	5.00
OSH56	56. Do the things done best	160	3.41	1.00	5.00
OSH57	57. Use skills from experience/training	160	3.26	1.00	5.00
OSH58	58. How much slowdown in the work load	160	2.59	1.00	5.00
OSH59	59. How much time to think	160	3.00	1.00	5.00
OSH60	60. How much work load	160	3.76	2.00	5.00
OSH61	61. Quantity of work others expect	160	3.81	2.00	5.00
OSH62	62. Time to do all work	160	3.41	1.00	5.00
OSH63	63. How many projects/assignments/tasks	160	3.40	1.00	5.00
OSH64	64. How many lulls	160	2.61	1.00	5.00
OSH65	65. Responsibility for future of others	160	2.96	1.00	5.00
OSH66	66. Responsibility for job security	160	2.23	1.00	5.00
OSH67	67. Responsibility for morale	159	3.08	1.00	5.00
OSH68	68. Responsibility for welfare and lives	160	3.01	1.00	5.00
OSH69	69. Great deal of concentration	159	1.69	1.00	4.00
OSH70	70. Remember many different things	160	1.25	1.00	4.00
OSH71	71. Keep mind on work at all times	160	1.99	1.00	4.00
OSH72	72. Take it easy and still get work done	160	2.37	1.00	4.00
OSH73	73. Let mind wander and get work done	160	2.71	1.00	4.00
OSH74	74. Take same type of job again	160	1.73	1.00	3.00
OSH75	75. Take same/different/no job	160	1.94	1.00	3.00
OSH76	76. Recommend similar job to friend	160	1.59	1.00	3.00
OSH77	77. All in all how satisfied with job	160	1.99	1.00	4.00
OSH78	78. Make a plan to solve the problem(s)	160	3.75	1.00	5.00
OSH79	79. Go on as if nothing has happened	160	1.99	1.00	5.00
OSH80	80. Feel responsible for the problem(s)	160	2.53	1.00	5.00
OSH81	81. Wish you could change the problem(s)	160	2.20	1.00	5.00
OSH82	82. Talk to boss/coworkers about problem	160	3.56	1.00	5.00
OSH83	83. Become involved in outside activity	160	2.56	1.00	5.00
OSH84A	84a. your immediate supervisor (boss)	160	3.66	1.00	5.00
OSH84B	84b. other people at work	160	3.67	2.00	5.00
OSH84C	84c. your spouse/partner	160	3.96	1.00	5.00
OSH84D	84d. your relatives	160	3.10	1.00	5.00
OSH84E	84e. your friends	160	3.42	1.00	5.00
OSH85A	85a. your immediate supervisor (boss)	160	3.93	2.00	5.00
OSH85B	85b. other people at work	160	4.03	2.00	5.00
OSH85C	85c. your spouse/partner	160	4.51	1.00	5.00
OSH85D	85d. your relatives	160	4.27	1.00	5.00
OSH85E	85e. your friends	160	4.28	1.00	5.00
OSH86A	86a. your immediate supervisor (boss)	160	3.84	2.00	5.00
OSH86B	86b. other people at work	160	3.61	2.00	5.00
OSH86C	86c. your spouse/partner	160	4.23	1.00	5.00
OSH86D	86d. your relatives	160	3.64	1.00	5.00
OSH86E	86e. your friends	160	3.70	1.00	5.00
OSH87A	87a. your immediate supervisor (boss)	160	3.78	2.00	5.00
OSH87B	87b. other people at work	160	3.62	1.00	5.00
OSH87C	87c. your spouse/partner	160	4.53	1.00	5.00
OSH87D	87d. your relatives	160	4.34	1.00	5.00
OSH87E	87e. your friends	160	4.23	1.00	5.00